CLAIMS

A process for the catalytic generation of hydrogen by the self-sustaining combination of partial oxidation and steam-reforming of a hydrocarbon comprising contacting a mixture of the hydrocarbon and an oxygen-containing gas and steam with a catalyst comprising rhodium dispersed on a refractory oxide support material which comprises as cations cerium and zirconium.

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A process according to claim 1 wherein steam is introduced into the mixture of 2. hydrocarbon and oxygen-containing gas after the self-sustaining partial oxidation of the hydrocarbon has commenced

A process according to daim 1 or 2 wherein the hydrocarbon is a straight chain 3. hydrocarbon or a branch chain hydrocarbon.

- A process according to claim 3 wherein the hydrocarbon contains 1 to 15 carbon atoms.
- 5. A process according to claim 4 wherein the hydrocarbon contains 1 to 7 carbon atoms.

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A process according to any one of the preceding claims wherein the hydrocarbon is 6. selected from methane, propane, butane, hexane, heptane, normal-octane, iso-octane, naphthas, liquified petroleum gas, reformulated petrol and diesel-type fuels.

7. A process according to any one of the preceding claims wherein the oxygen-containing gas is air.

8. A process according to any one of the preceding claims wherein rhodium comprises .0.1 weight per cent to 5 weight per cent of the total weight of the supported catalyst.





A process according to claim 8 wherein rhodium comprises 0.2 weight per cent to 2.5 weight per cent of the total weight of the supported catalyst.

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- 10. A process according to any one of the preceding claims wherein the refractory oxide support material is a mixture of ceria and zirconia.
- 11. A process according to claim 10 wherein the weight ratio of ceria to zirconia in the catalyst support material is from 0.5 to 99.5 to 99.5 to 0.5
- 10 12. A process according to claim 11 wherein the weight ratio of ceria to zirconia in the catalyst support material is from 5 to 95 to 95 to 5.

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- 13. A process according to any one of the preceding claims wherein the catalyst is pre-heated to a temperature at which self-sustaining partial oxidation of the hydrocarbon commences.
- 14. A process according to claim 13 wherein the catalyst is pre-heated by direct heating to a temperature at which self-sustaining partial oxidation of the hydrocarbon commences.
- 15. A process according to claim 13 wherein the catalyst is pre-heated by catalytic heating to a temperature at which self-sustaining partial oxidation of the hydrcarbon commences.
- 16. A process according to claim 15 wherein the catalyst is pre-heated by feeding to the catalyst an oxygen-containing gas and an initiating compound which is more easily oxidisable than the hydrocarbon which is to be partially oxidised.
 - 17. A process according to claim 16 wherein the initiating compound is selected from methanol, hydrogen and dimethyl ether.



- 18. A process according to any one of the preceding claims wherein the mixture of hydrocarbon and oxygen-containing gas is fed to the catalyst when the catalyst has reached the temperature at which self-sustaining partial oxidation of the hydrocarbon will occur.
- 19. A process as claimed in any one of the preceding claims operated in combination with a catalysed water-gas shift reaction for the reduction of carbon monoxide in the hydrogen produced from the hydrocarbon.
- 20. A process as claimed in claim 19 wherein the catalyst for the water-gas shift reaction is a copper or iron based catalyst.

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- 21. A process according to claim 19 or 20 wherein the water-gas shift reaction catalyst is added to the rhodium based catalyst for the hydrogen generation reaction.
- 22. The use in a fuel cell system of the process as claimed in any one of the claims 1 to 21 for the catalytic generation of hydrogen.

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